Regional-Scale Climate Variability on Decadal to Century Timescales

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This work focuses on improving knowledge of decadal- to century-scale natural climate patterns, and the linkages between large-scale and regional climate variability. We address the following issues related to specific DOE Climate Change Prediction Program objectives, with a particular focus on studies of climate response (natural versus forced variability) and critical data needs for global change research:

1. Investigations of the spatial expressions of teleconnection patterns related to such large-scale features of the climate system as El Niño-Southern Oscillation (ENSO), Pacific Decadal Oscillation (PDO), North Atlantic Oscillation (NAO), Arctic Oscillation (AO), etc., during the course of 20th century warming. This will involve studies of regional temperature and precipitation anomalies under changing background climate conditions.

2. Certain regions of the world have been identified as "critical systems at risk" from future climate change. Among these are high elevation or mountainous regions, arid/semi-arid boundary zones, and subarctic margins. We will examine changes in these high-risk regions as a function of changes in background climate, ranging from century-scale trends to decadal-scale features of climate, such as the PDO.

3. Analysis of changes in the frequency of occurrence and persistence of extreme events defined on varying timescales (from days to years). We will stratify the data according to the alternating phase of the principal large-scale modes of variability in the modern climate system, such as PDO, NAO, etc., and determine if the characteristic patterns exhibit changes through time.

4. In order to assess the temporal characteristics of sudden changes in the mean and variance of seasonal temperature and precipitation at different spatial scales, we will use paleoclimate records as an extension of the ~100-year instrumental record, prior to large-scale anthropogenic effects.

The focus of the current project is regional-scale climate variability on decade to century timescales. Because of the long duration and potentially large magnitude of effects, decade-to-century (DEC-CEN) climate changes can have a substantial impact on society. To understand the principal characteristics of such variability requires a firm understanding of the following:

- What are the spatio-temporal patterns of DEC-CEN variability and what mechanisms give rise to them?

- What is the relationship between natural DEC-CEN variability and observed global warming? What do we have to know about natural variability in order to detect anthropogenic climate change?
- How does variability in the forcings, both natural and anthropogenic, affect DEC-CEN variability?
- What is the role of interaction among the climate components in generating and sustaining DEC-CEN variability?

List of Publications:

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